

# **Deep Researcher**

# **Cloud-Based Intelligent Research Assistant**

**Powered by LLM**

**Presented by:**

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# Deep Researcher: AI-Powered Iterative Research

AI becoming integral to research and data summarization

Limitations of traditional AI research tools:

- Static, one-time summaries
- Lack of iterative refinement
- Incomplete or surface-level insights

Deep Researcher solution:

- Intelligent research loop
- Continuous refinement of queries and summaries
- Knowledge gap identification
- Context-aware results

# Cloud Implementation

## Deployment

Deployed on Amazon ECS with  
AWS Fargate

## High Availability

Ensures system remains  
accessible and operational

## Serverless Approach

No manual infrastructure  
management required

## Resource Efficiency

Automatic scaling and improved resource utilization

## Cost Efficiency

Pay only for resources actually used

# Cloud Computing Benefits



## Scalability for computationally intensive AI tasks

Handles varying workloads efficiently



## Operational efficiency

Automated resource allocation



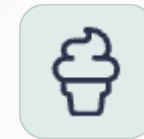
## Demand-based scaling

Resources adjust to actual usage patterns



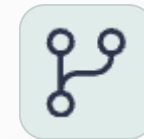
## Enhanced security

Robust protection for sensitive research data



## Elimination of infrastructure overhead

Focus on research rather than maintenance



## Consistent execution environments

Simplified version control and deployment

# System Architecture and Design

## Frontend Interface

User interaction point

## Report Generator

Creates final output

## Iteration Engine

Refines research process



## Query Generator

Creates optimized search queries

## Web Scraper

Collects relevant data

## Summarization Engine

Analyzes knowledge gaps

Cloud Infrastructure (AWS ECS, Fargate) provides the foundation for all components

# Security Mechanisms

1

## Security Groups

Virtual firewalls controlling inbound/outbound traffic



## AWS Load Balancer

Protection against DDoS attacks



## AWS Firewall

Enforces network security rules



## IAM Roles and Policies

Restricts access to cloud resources

### Benefits:

- Robust protection
- Secure data processing
- Prevention of unauthorized access
- Maintained integrity and reliability

# Workflow of Deep Researcher

## Query Generation

- User provides research topic
- Fine-tuned model generates optimized search query

## Web Search and Data Retrieval

- Real-time web search
- Information extraction from credible sources

## Summarization

- Data processing by fine-tuned model
- Initial summary generation

## Knowledge Gap Identification

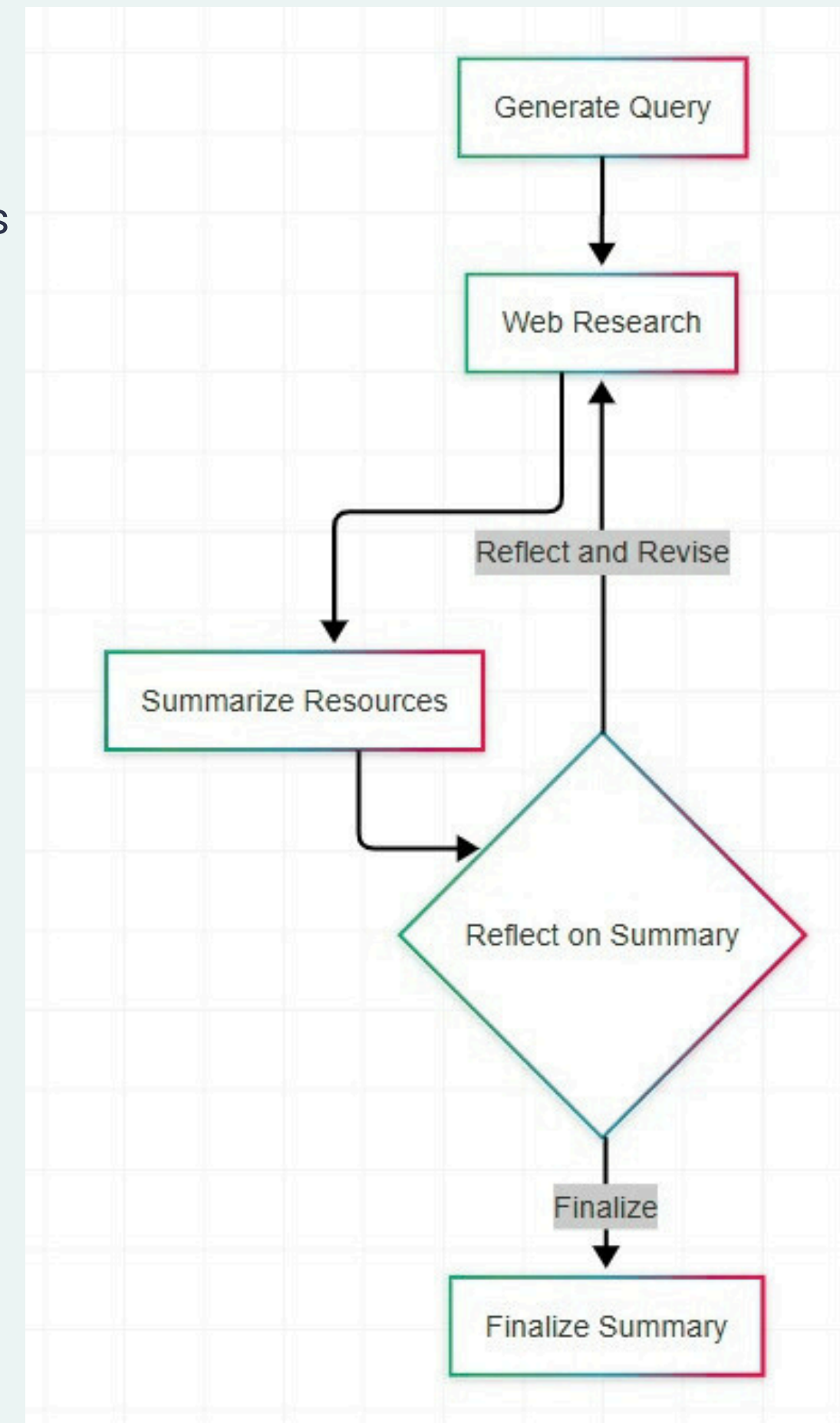
- Evaluation of summary completeness
- Identification of areas needing deeper exploration

## Iterative Refinement

- Search query modification based on gaps
- Repeated search process for specified iterations
- Continuous enhancement of depth and accuracy

## Final Report Generation

- Source citation
- Compilation into structured markdown report
- Comprehensive and well-referenced output





# Cloud Deployment and Scalability

## Deployment Process

### 1. Containerization

- System containerized using Docker
- Ensures portability and consistent execution

### 2. Image Storage

- Container image pushed to AWS ECR
- Centralized repository for management

### 3. ECS Task Definition

- Image used to define ECS tasks
- Tasks run within ECS clusters using AWS Fargate

## Infrastructure and Scaling

### 1.ECS Cluster Creation

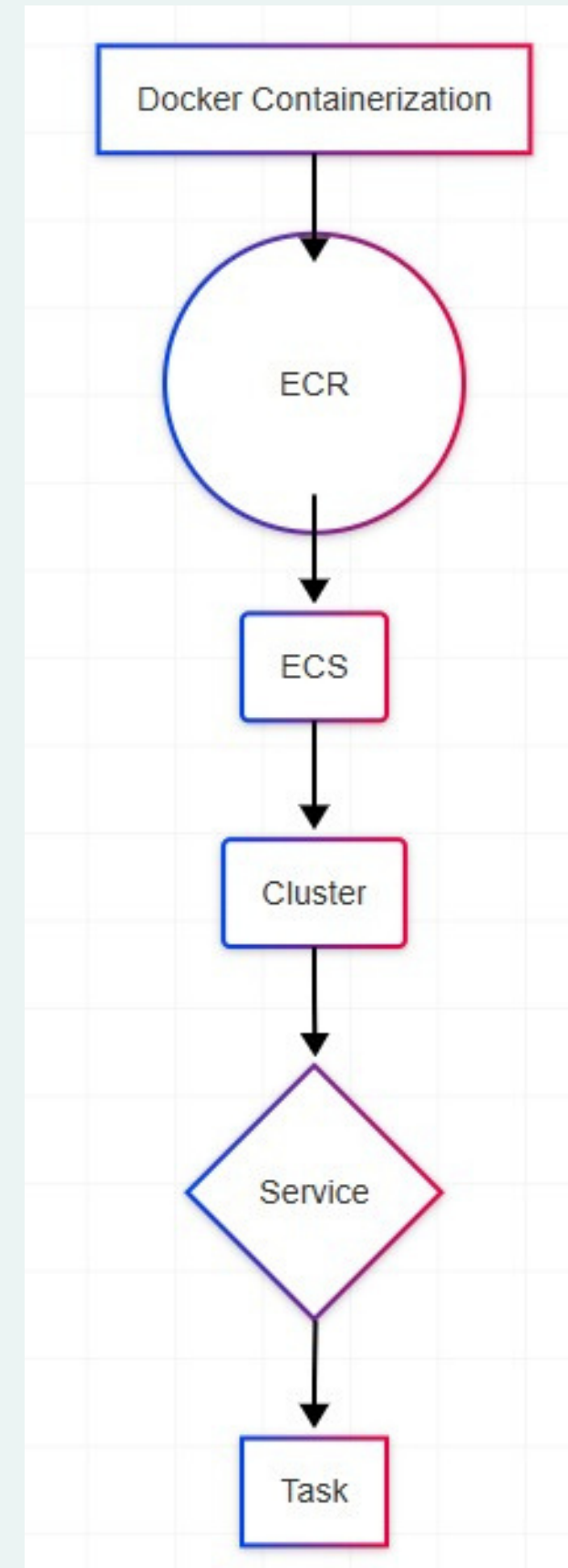
- Serverless cluster for containerized workload management
- Automatic resource scaling

### 2.Task Creation and Execution

- Specification of container images, CPU, memory, network
- Automatic compute resource management via AWS Fargate

### 3.Service Definition

- API layer for running tasks
- Container lifecycle maintenance
- Continuous availability assurance





# Load Balancing and Traffic Management

## Load Balancer

AWS Load Balancer linked to ECS service

## Self-Healing

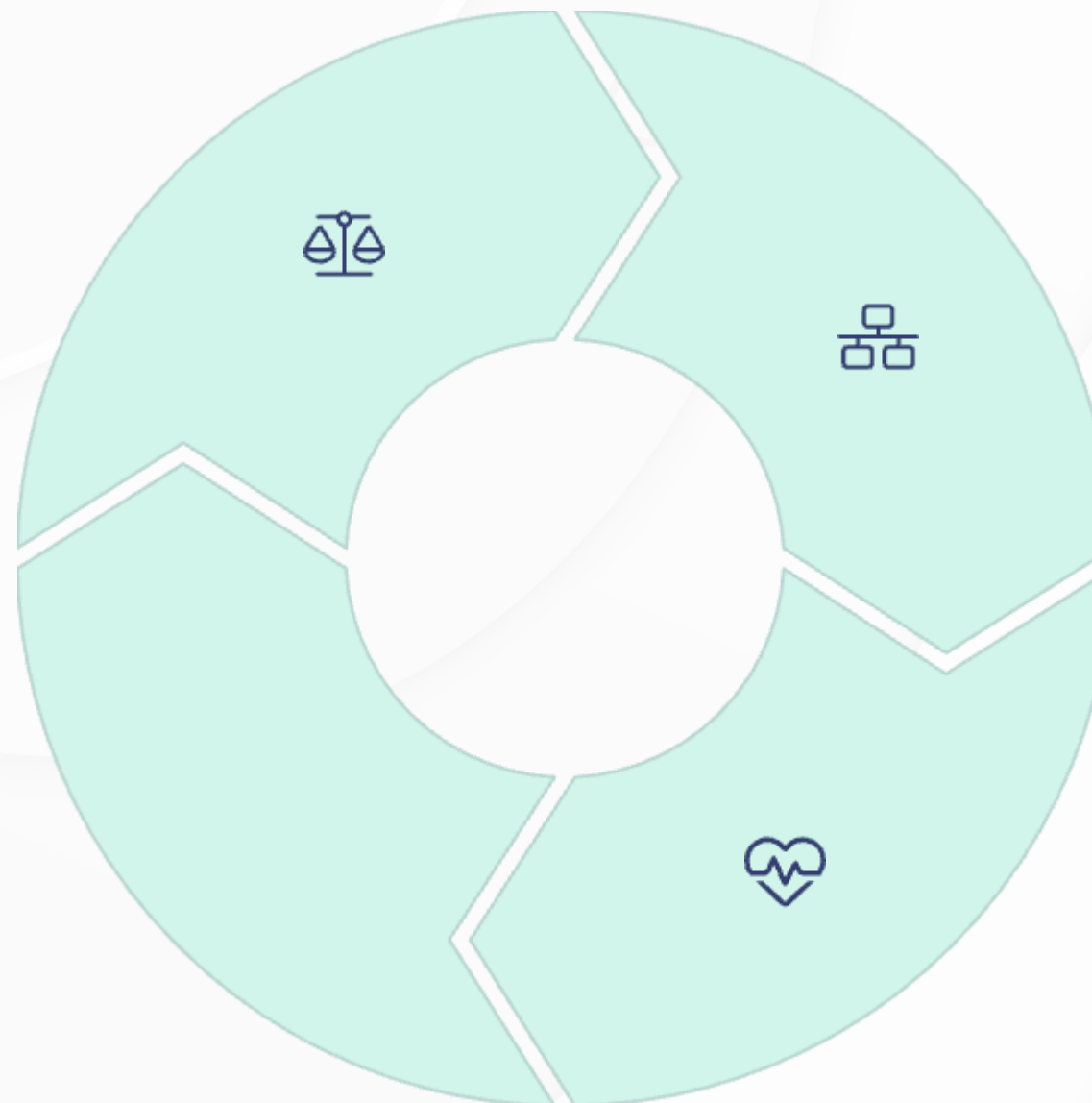
Automatic replacement of unhealthy containers

## Request Distribution

Efficient request distribution

## Health Monitoring

Container health monitoring via /health route



The system provides self-healing capabilities and uninterrupted availability through its comprehensive health monitoring and automatic container replacement.

# Automated Deployment and Updates



## Container Update

Modified Docker container pushed to ECR



## Deployment Trigger

New deployment triggered using "Force New Deployment"



## Container Replacement

Automatic replacement of old containers

## Safe Rollout Strategy:

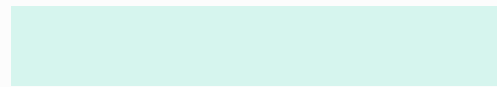
- New containers created with updated code
- Old containers preserved until new ones pass health checks

## Failure Recovery:

- Old containers remain active if new ones fail
- Prevention of system downtime

# Resource Management

The cleaning up process ensures that all resources are properly released when they are no longer needed, preventing unnecessary costs and resource consumption.



Set Task Count to Zero

Begin the cleanup process by setting the desired task count to zero



Stop and Deregister Service

Stopping and deregistering ECS service



Delete ECS Cluster

Deleting ECS cluster to free resources

# Results and Evaluation



## Successful Workflow Execution

Successful execution of automated research workflow



## Test Query

**"System Evolution Analytics:**  
Pattern Mining and Deep Learning of an Evolving System"



## Structured Summary

Structured summary with key concepts

Key concepts identified in the structured summary include:

- Network pattern learning
- Deep learning-based evolution analysis
- Cloud-based applications (AWS, Eucalyptus)

# Evaluation Results



Recommendations for further exploration include:

- System Evolution Analytics models
- Scalability considerations
- Real-world applications

# Performance Highlights



## Efficient Query Execution

Efficient automated query execution



## Effective Synthesis

Effective result synthesis



## Enhanced Usability

Enhanced usability



## Downloadable Summaries

Downloadable summaries

The system demonstrates improved user experience through its efficient query execution, effective synthesis of results, enhanced usability features, and the ability to download comprehensive summaries.



# Source Information


## DeepResearch Assistant


Enter any research topic or question, and I'll analyze information from various sources to provide you with a comprehensive research summary.

Using Local Model

Research Topic or Question

System Evolution Analytics: Pattern mining and Deep learning of an Evolving system

 Research

 Clear Results

# Sample Output

Research Summary Source Information

## Research Summary

System Evolution Analytics is based on proposed System Evolution Learning. The network pattern information is trained using deep learning. The technique can be used to analyze the evolving system. Such techniques can be applied on an evolving web service system on two cloud services: the AWS, and the Eucalyptus. For more information on System Evolution Analytics, visit: <http://www.systemevolutionanalytics.com/SystemEvolutionAnalytics.php/>. For more about SystemEvolution Analytics, see: <http://www.systemevolutionanalytics.org/SystemevolutionAnalysts.php>. for more information about the model, visit <http://www.systemevolutionanalytics.com/>. For further information about System Evolved Analytics, please visit:<http://www.systemevolvedanalysts.com>.

## Key Findings


- The search found 7 relevant sources related to " System Evolution Analytics: Pattern mining and Deep learning of an Evolving system"
- The sources include various perspectives on the topic
- The information was collected from web search results

## Sources Overview ⇄

- 7 web sources were analyzed
- Sources include a mix of websites with varying degrees of specificity
- Some sources may provide more comprehensive information than others

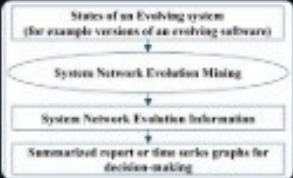
## Further Research Directions

- Consider exploring more specific aspects of " System Evolution Analytics: Pattern mining and Deep learning of an Evolving system"
- Look for academic or specialized sources for more in-depth analysis
- Compare information across different time periods or contexts

 Download Summary

# Sample Output

[Research Summary](#) [Source Information](#)



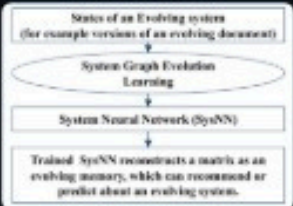
```
graph TD; A[States of an Evolving system  
(for example versions of an evolving software)] --> B[System Network Evolution Mining]; B --> C[System Network Evolution Information]; C --> D[Summarized report or time series graphs for  
decision-making];
```

Deep Evolution and Change  
Learning of Inter-Connec

## 1. Deep Evolution and Change Learning of Inter-Connected ...

In this paper, we introduce a System Evolution Analytics model, which is based on proposed System Evolution Learning. The network pattern information is trained ...

[Visit Source](#)




```
graph TD; A[States of an Evolving system  
(for example versions of an evolving document)] --> B[System Graph Evolution Learning]; B --> C[System Neural Network (SysNN)]; C --> D[Trained SysNN reconstructs a matrix as an  
evolving summary, which can recommend or  
predict about an evolving system.];
```

System Evolution Analytics based  
on Network Data S

## 2. System Evolution Analytics based on Network Data Science

Sixth, we discuss the change mining and evolution mining of an evolving web service system on two cloud services: the AWS, and the Eucalyptus.

[Visit Source](#)




The Evolution of AI in Data Insights

Animesh Chaturvedi - PhD  
Research Thesis

## 3. Animesh Chaturvedi - PhD Research Thesis

A technique can be used to analyze the evolving system; the technique is named as System Evolution Analytics. Such techniques can be applied on an evolving ...

[Visit Source](#)



Overview of the System Evolution Analytics mode

An overview of the System  
Evolution Analytics mode



# Thank You

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**Github Link:**

<https://github.com/DataScience-ArtificialIntelligence/deep-researcher.git>